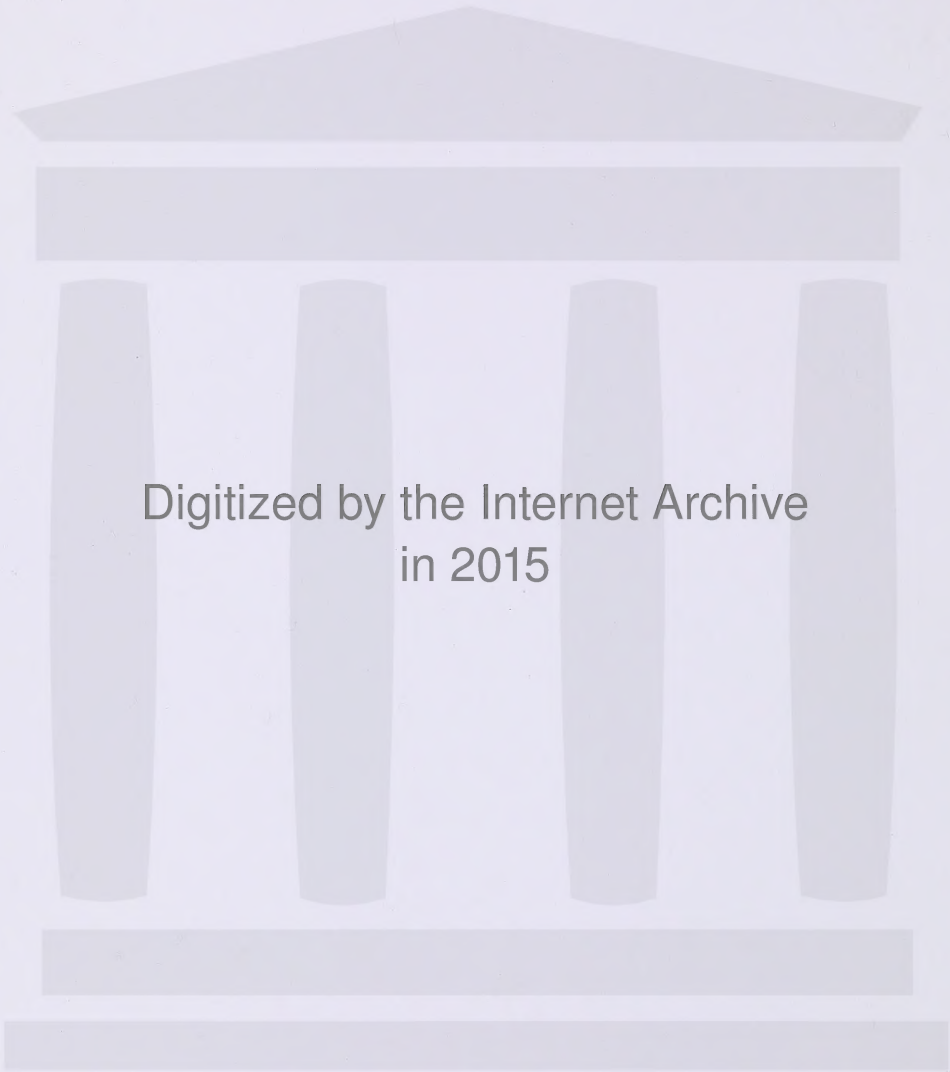
# AIR TOXICS

# MANAGEMENT PROGRAM

# IN ALBERTA

Alberta
ENVIRONMENTAL PROTECTION



# Air Toxics Management Program in Alberta

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## SUMMARY

This document presents an overview of the existing management system for controlling industrial air toxics emissions.

Alberta's regulatory approach to industrial air toxics management system has been evolved over the past years. The system is consistent with the management program for criteria air pollutants (sulphur dioxide, nitrogen dioxide, hydrogen sulphide, carbon monoxide, ground level ozone, suspended particulates, ammonia, and static fluorides) and complementary to the federal program. The key components of the Alberta Industrial Air Toxics Management Program include goals, policies, ambient guidelines or prescribed ambient levels, source emission standards, plume dispersion modelling, ambient air and source emissions monitoring, environmental reporting, emission inventory, approvals, inspections/abatement, enforcement and research. The program was designed to ensure that air toxics emissions are minimized through the use of Best Available Control Technology for carcinogens and Best Available Demonstrated Technology that is economically achievable for other air toxics, and to ensure that ambient air quality meets Alberta's guidelines or prescribed ambient levels. The Alberta Ambient Air Quality Guidelines and prescribed ambient levels of air toxics used in the Alberta industrial air toxics management program are included.

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## BACKGROUND

Management of environmental toxics is a major issue on the environmental policy agenda in Canada and around the world. One of the most important reasons for the high profile of air toxics management is the growing scientific evidence that long-term, low-level exposure can occur from the atmospheric transport of pollutants over long distances and that the substances are associated with effects on human health and the environment. No region, however remote, is assured of being safe from airborne toxic pollutants. Recognizing the significance of air toxics, it is important to document the Alberta air toxics management program.

A substance is an air toxic substance if it enters or may enter the atmospheric environment in a quantity or concentration or under conditions (a) having or that may have an immediate or long-term effect on the environment; (b) constituting or that may constitute a danger to the environment on which human life depends; or (c) constituting or that may constitute a danger in Alberta to human life or health. [1,2]

Generally, there are five different chemical types of toxic substances: metals and metalloids (e.g., arsenic, lead, and mercury); respirable mineral fibres (e.g., asbestos); inorganic gases (e.g., fluorides, total reduced sulphur); non-halogenated organic compounds (e.g., aldehydes, benzene, polycyclic aromatic hydrocarbons); and halogenated organic compounds (e.g., vinyl chloride, chlorobenzene).

In addition to air toxics there are other air pollutants commonly called criteria pollutants and they include sulphur dioxide, carbon monoxide, ozone, nitrogen dioxide, and total suspended particles. The causal or associational relationship between ambient level/dosage and effect of these substances has been developed by Environment Canada. The Federal-Provincial Advisory Committee on Air Quality under the Canadian Environmental Protection Act (CEPA) published criteria documents for these substances and recommended National Air Quality Objectives.

Alberta Environmental Protection has established ambient bench-mark levels for criteria pollutants. They are specified in the Alberta Ambient Air Quality Guidelines (Appendix A). Besides these pollutants, ambient air quality guidelines have been developed by Alberta Environmental Protection for hydrogen sulphide, dustfall, dust and smoke, and ammonia. Static exposure levels of total sulphation, hydrogen sulphide and fluorides have also been set. The levels specified in these Guidelines are used as a tool to assess air quality, to assist in setting emission standards, to design stacks at industrial facilities, and to guide and evaluate monitoring. They are also used to initiate control action at industrial facilities. The Alberta Ambient Air

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[1] Both Alberta Environmental Protection and the Alberta Clean Air Strategic Alliance's (CASA) Air Toxics Project Team use this definition.

[2]The draft policy for management of toxic substances developed by the Canadian Council of Ministers of Environment states that a substance is considered toxic if it meets or is equivalent to the definition of "toxic" found in Section 11 of CEPA. That definition is similar to the one given here.

Quality Guideline levels for criteria pollutants were based on the National Air Quality Objectives, and for the most part, Alberta has adopted the most stringent levels from the National Air Quality Objectives.

## SOURCES AND GROUPS OF AIR TOXICS IN ALBERTA

Alberta is primarily an agriculture, resource and energy-producing province with its human population concentrated in two major urban centres. Potential sources of air toxics include:

- Chemicals
- Construction
- Food and Animal By-products
- Metals and Minerals Processing
- Oil and Gas
- Power Plants
- Solvents from dry cleaning and printing facilities.
- Vehicle exhausts, wood burning stoves and fire places
- Waste incinerators
- Wood Products

A list of potential toxic substances in Alberta is given in Table 1. Linkages pertinent to initiatives within the federal Canadian Environmental Protection Act are also given. Substances are grouped with respect to their classification process in the Canadian Environmental Protection Act. The CEPA Priority Substances Assessment Program determines if substances are toxic and develops management actions (Appendix B). In the program, Priority Substances Lists (PSL-1 and PSL-2) were established. Results of the Priority Substances Assessment Program appeared in public reports that outline why a substance was or was not found toxic under the Canadian Environmental Protection Act.

In Table 1, CEPA linkage refers to groupings pertinent to initiatives in the federal Canadian Environmental Protection Act as follows:

1. Substances identified as toxic in the PSL-1 assessment which have gone or will go through the Strategic Option Process for management actions.

2. Substances identified as non-toxic in the PSL-1 assessment which require further risk-based assessment with Alberta concentrations and the assignment of management actions if they prove to be toxic in Alberta.

3. Substances with insufficient information in specific aspects of the PSL-1 assessment to conclude whether they are toxic. Further information is required to determine if the substances are toxic and what control strategies need to be taken. Management actions await more information.

4. Substances being assessed on PSL-2. Relevant chemical, biological, human health, and environmental information will be compiled nationally. Management actions will be assigned when the PSL-2 assessment is completed.

5. Substances present in Alberta but not included on any PSL lists. Alberta risk-based assessments are required to determine toxicity before management actions can be assigned.

6. Criteria pollutants specified in the Alberta Ambient Air Quality Guidelines (Appendix A).

## ALBERTA'S AIR QUALITY MANAGEMENT SYSTEM

### Goals.

Alberta Environmental Protection, together with industry and environmental groups as stakeholders of CASA, has developed the following goals for management of air quality:

(a) To protect the environment;
(b) To optimize economic performance and efficiency; and
(c) To seek continuous improvement.

These goals are not to be taken as individual and discrete components but rather are to be considered collectively with balance among elements. Alberta Environmental Protection works with Albertans to protect and enhance the quality of the air through regulatory management approach which includes: ambient guidelines, source emission standards, plume dispersion modelling, ambient and source emissions monitoring, environmental reporting, emission inventories, approvals, inspections/abatement, enforcement and research.

### Policies.

Alberta has a number of key policies which guide the management of industrial air toxics. These are as follows:

- industrial facilities must be designed and operated in accordance with the pollution prevention principle;
- emissions from each industrial source must be controlled using:
  (a) the best available control technology for carcinogens; and
  (b) best available demonstrated technology that is economically achievable for other air toxics;
- residual emissions must be dispersed through a stack designed to keep ambient concentrations below regulated levels;
- cumulative impacts from multiple sources must be considered;

- industrial operators must monitor stack emissions and the resulting ambient concentration around their facilities to demonstrate compliance with emission limits and ambient guidelines or prescribed levels; and
- industrial operators must report the monitoring results to the government.

**Ambient Guidelines or Prescribed Ambient Levels.**

Ambient air quality guidelines provide a basis of determining what is acceptable air quality. For non-criteria substances for which there are no Alberta guidelines, acceptable ambient levels are generally determined using the Texas "Effects Screening Levels" or Ontario's "Point-of-Impingement Standards". Consideration is also given to industrial occupational health standards such as those found in the Alberta Occupational Health Act, the American Conference of Governmental Industrial Hygienist's (ACGIH) "Threshold Limit Values" and ambient standards from other jurisdictions. Normally, occupational health or industrial hygienist limits are reduced by an order of magnitude to put into the perspective of ambient concentrations. Ambient levels for substances other than the criteria substances currently regulated under Approvals in Alberta are given in Table 2.

**Source Emission Standards.**

To ensure that the quality of the ambient air is maintained within ambient guidelines, emissions of various air contaminants must be restricted. This is done through regulating these emissions by legislation and management using an approval system. Under the approval system, regulated industries and facilities are allowed to emit limited amounts of various air contaminants. These emissions limits or source emission standards are specified in approvals issued to specific facilities.

The determination of air toxics source emission standards for any given facility requesting or applying for an approval is dependent on:

1. The existing air quality;

2. Ambient air quality guidelines or prescribed ambient levels;

3. Source emission standards based on the:
   - nature of the air contaminant, that is, carcinogenic or not,
   - nature of the process industry,
   - air pollution technology that is determined to be the
     - best available demonstrated, or
     - best available;

4. The results of air dispersion modelling which takes into account the
   - local meteorology and terrain, and
   - surrounding emission sources.

For substances with national or international agreements on emission limits, the agreed-upon emission limits are applied. The CCME or CEPA emission standards for Dioxins/Furans, Polychlorinated Biphenyls and Vinyl Chloride are used for applicable facilities in Alberta. To address concerns about benzene emissions from glycol dehydrators, the Environment Canada sponsored Benzene Working Group, a broad multi-stakeholder consultative group, was formed. Subsequently, an Informational Letter (IL 97-4) was issued jointly by Alberta Environmental Protection and Alberta Energy and Utilities Board to announce a program formulated by this group to reduce benzene emissions from glycol dehydrators. Benzene emission standards for these facilities were established. Values of emission limits for these air toxics are as follows:

| | |
|---|---|
| Dioxins and furans | 0.5 ng Teq[a]/$m^3$ |
| Polychlorinated biphenyls | 1 ppm of throughput or 99.9999% DE[b] whichever is more stringent |
| Vinyl chloride | 10 ppm and 2 kg/day |
| Benzene (glycol dehydrators) | Less than 9.0 tonnes per year by Jan 1999 for existing and 3.0 tonnes/year for new facilities,<br>3.0 tonnes/year within 0.75 km of permanent residents, 5.0 tonnes/year for others by Jan 2001. |

[a]Teq – Toxic Equivalent
[b]DE – Distruction Efficiency

**Plume Dispersion Modelling.**

Plume dispersion models are tools that link stack emissions to ambient concentrations. Once an emission limit for a particular source has been set, the models are used to determine the required stack height to properly disperse any residual air contaminants, thus ensuring that the prescribed ambient levels are met. These models use information on emission characteristics such as pollutant mass emission rate, gas temperature and flow rate to predict the maximum ground level concentrations that can occur over a wide range of possible meteorological conditions, including the worst case atmospheric conditions. Modelling is also used in the siting of air monitoring stations in the vicinity of industrial facilities and takes into account all other sources of similar air contaminants being emitted in the area, i.e. cumulative impacts.

Alberta has developed a number of different plume dispersion models for use by industry. Information on these models is documented in a User's Manual published by Alberta Environmental Protection. Alberta is currently in the process of adopting the U.S. Environmental Protection Agency's plume dispersion models. Guidelines on their use in Alberta are being developed.

**Ambient Air Monitoring.**

Some industries are required to conduct ambient air quality monitoring for specific toxic pollutants as part of the conditions in their Approvals. The number of monitoring stations,

frequency and duration of monitoring or sampling, measuring or sampling techniques, and analytical methods, if necessary, are dependent upon the pollutant to be monitored and its emission rate. The chemicals, excluding criteria pollutants (e.g., sulphur dioxide, nitrogen oxides, ozone, etc.), monitored by industry in Alberta are shown in Appendix A.

Ambient monitoring for toxic pollutants takes various forms. Perimeter monitoring consists of taking discrete samples of chemical compounds at various locations along the property boundary of the plant for specified periods. The compounds are considered to be of significance either from a quantity or a health and environmental effect standpoint. Another form of ambient monitoring is installing a continuous monitor in a permanent station located at the point of predicted maximum ground level concentration, maximum frequency of exposure direction, or for other considerations. An example of this is ammonia. Alberta Environmental Protection also considers other innovative ambient monitoring programs such as remote sensing.

Alberta Environmental Protection operates a comprehensive air and precipitation quality monitoring program throughout the province. The program consists of continuous (hourly), intermittent (daily), passive (monthly) and precipitation quality (weekly) networks. Air quality parameters collected by continuous methods include carbon monoxide, dust and smoke, oxides of nitrogen, ozone, total hydrocarbons, inhalable particulates ($PM_{10}$ and $PM_{2.5}$), ammonia, sulphur dioxide, hydrogen sulphide and carbon dioxide. Intermittent monitoring refers to air quality parameters that are collected as a 24-hour accumulated loading according to the National Air Pollution Surveillance (NAPS) network. Parameters monitored on an intermittent basis include total suspended particulates, particulate sulphate and nitrate, polycyclic aromatic hydrocarbons in particulate matter, inhalable particulates ($PM_{10}$ and $PM_{2.5}$), inhalable particulate composition and over 150 volatile organic compounds. Passive methods are used to monitor sulphur dioxide, nitrogen dioxide and ozone as a 30-day accumulated loading. Precipitation quality samples are collected on a weekly basis and analyzed for acidity as well as several major anions and cations. In additional to routine air quality monitoring, polycyclic aromatic hydrocarbons, volatile organic compounds, particulates, dioxins, furans, polychlorinated biphenyls (PCBs) and sulphur compounds are also monitored in response to public concerns or requests from municipalities.

**Source Emissions Monitoring.**

(1) In-stack Emission Monitoring: There are two types of in-stack emission monitoring requirements in Approval conditions. These are manual stack surveys and continuous emission monitoring. Manual stack surveys are short duration tests, usually consisting of three one-hour tests. Stack sampling trains are used to collect effluent gas samples from the stack and samples are analyzed at laboratories. These surveys are conducted by specially-trained stack sampling personnel in accordance with the reference methods contained in the Alberta Stack Sampling Code. The Code is periodically updated to reflect new methods and procedures. In addition to conducting manual stack surveys, facilities that emit large quantities of substances must conduct continuous emission monitoring with proven continuous monitoring technology if available. This is done with instruments permanently installed on the stack. Measurements of the concentration and flow rate allow the mass emission rate to be determined on an ongoing, year round basis.

Requirements are set out in the Alberta Continuous Emission Monitoring Systems (CEMS) Code.

(2) Fugitive Emission Monitoring: A significant amount of volatile organic compounds can be emitted from leaking valves, flanges, sampling connections, pumps, pipe and compressors. Emissions of these types are commonly called fugitive emissions. Industries, especially organic chemical plants and hazardous waste treatment plants, are required through their approvals under the Alberta Environmental Protection and Enhancement Act to implement fugitive volatile organic compound monitoring programs which will detect leaks in process equipment and piping, and prompt corrective action (e.g., repairs or replacement). The reports of such activities are sent to Alberta Environmental Protection as specified in their Approvals.

**Environmental Reporting.**

Industry is required to submit monitoring reports to Alberta Environmental Protection. Reporting requirements are specified in approvals under the Alberta Environmental Protection and Enhancement Act, and vary depending on the chemicals, size and nature of the facility. The reports summarize ambient and source monitoring data and provide information on the quality assurance and quality control measures performed and on trend analyses. The reports also outline problems which may have arisen and corrective actions taken. The formats for the reports are specified in the *Air Monitoring Directive*. Reports are currently submitted in paper format.

For certain types of environmental incidents, immediate reporting is required under the Environmental Protection and Enhancement Act and the associated Release Reporting Regulation. Alberta Environmental Protection has prepared a document entitled *Release Reporting Guideline*, which provides additional details on what types of situations require immediate reporting.

**Emission Inventory.**

Alberta Environmental Protection avoids duplication of federal initiatives on emission inventory. Under the National Pollutant Release Inventory (NPRI) program of the Canadian Environmental Protection Act, anyone in Canada who owns or operates a facility with 10 or more full-time employees in the reporting year and manufactures, processes or otherwise uses any of the NPRI-listed substances in concentrations equal to or greater than 1% of the emission and in quantities equal to or greater than 10 tonnes must file a report with Environment Canada and identify any release or transfers in waste on those substances to air, water or land. There are currently 178 substances on the NPRI list. Information of Alberta air toxics emissions per plant-scale is available in the NPRI database. These data can be downloaded from the NPRI web site at **http://www.ec.gc.ca/pdb/npri.htm**.

The 1990 emission inventories of some Persistent Organic Pollutants, mercury, cadmium and lead have been developed by the National Emission Inventory and Projection Task Group of the National Air Issues Coordination Committee of the Canadian Council of Ministers of Environment/Council of Energy Ministers Joint Committee. These inventories were developed in

support of the negotiation of the protocols on Persistent Organic Pollutants and Heavy Metals under the United Nations Economic Commission for Europe convention on Long Range Transboundary Air Pollution,

**Approvals.**

Regulatory Approvals issued pursuant to the Alberta Environmental Protection and Enhancement Act are the key implementation tool for the operation of the industrial air quality management system. They incorporate:

- source emission limits;
- required pollution control equipment/technologies and allowable emission sources;
- operational procedures required to minimize emissions;
- stack design criteria based on plume dispersion modelling to ensure prescribed ambient levels are met; and
- environmental monitoring and reporting requirements, including emission inventory data.

Prior to the Alberta Environmental Protection and Enhancement Act coming into effect on 1 September 1993, companies were issued Permits to Construct by Alberta Environmental Protection to cover the ongoing operation of plants. Also, separate permits and licences were issued for the air and water pollution control components of facilities. Under the Environmental Protection and Enhancement Act, an integrated, single environmental approval is issued. These approvals cover all phases of an industrial operation, including construction, operation, and reclamation. As well, these new integrated approvals address all environmental aspects including air, industrial waste water, hazardous and solid wastes, groundwater, soils, sanitary sewage/waterworks, and reclamation and decommissioning aspects of facilities in a single approval.

The approvals under the Alberta Environmental Protection and Enhancement Act can be issued for a duration of up to ten years (as opposed to a maximum period of five years under the previous Clean Air and Clean Water Acts). The approvals process also allows for public input and has an appeal mechanism that is administered by the Environmental Appeal Board.

**Inspections/Abatement.**

To develop and maintain regulatory programs that are effective at minimizing air contaminant emissions requires staff who understand the capabilities and limitations of various control strategies in the field environment. This understanding and expertise is obtained through: inspections of facilities; reviewing and following up on air monitoring reports; conducting stack surveys in some situations; and in other situations, assisting in the development and implementation of abatement strategies to prevent or minimize potential environmental problems at a particular facility. The intent of inspections and abatement activities is not only to develop expertise and experience but also to ensure a strong "regulatory" presence which demonstrates to operators and the public that Alberta is committed to ensuring the proper operation of emission control systems.

**Enforcement.**

The regulatory philosophy of Alberta Environmental Protection with respect to enforcement in Alberta is that it be administered firmly but fairly, in a timely and consistent manner.

For infractions of environmental laws (i.e. legislation, approval conditions, etc.) the Alberta Environmental Protection and Enhancement Act has a wide range of enforcement tools which can be employed by Alberta Environmental Protection. These include:

- warning letters;
- tickets;
- enforcement orders;
- administrative penalties;
- prosecutions;
- court orders; and
- cancellation of approvals.

The enforcement action taken is dependent on the circumstances surrounding the particular situation and the past history of the operation. Generally, companies experiencing difficulties in meeting Alberta Environmental Protection approval requirements will voluntarily take appropriate actions to achieve compliance.

**Research.**

Alberta Environmental Protection is funding the Alberta Research Council on the following research projects relating to the subject of air toxics:

- ethylene effects on crop growth and yield under controlled environmental condition;
- assessment of terrestrial emission of volatile organic compounds;
- source characterization of airborne particulate matter;
- stack volatile organic, organosulphur, and chlorinated volatile organic compounds emissions from sour gas plants;
- dioxins and furans in the ambient air;
- evaluation of a tuneable diode laser for measuring ammonia emissions from Snowfluent™ treatment of liquid hog manure; and
- determination of best available technologies for the removal of liquid from solution gas stream directed to flare and development of a method to establish the relationship between liquids in solution gas and flare combustion efficiency.

## OTHER ACTIVITIES OF RELEVANCE

Alberta Environmental Protection is participating in various Project Teams of the Alberta Clean Air Strategic Alliance to review and develop management actions of air toxics in Alberta.

Alberta has implemented the Volatile Organic Compounds Control initiatives of the Management Plan for Nitrogen Oxides (NOx) and Volatile Organic Compounds (VOCs) of the Canadian Council of Ministers of Environment.

Alberta also has a voluntary vehicle inspection and maintenance program aimed at reducing smog. The SMOG FREE program in Edmonton and Calgary is operated by the motor vehicle servicing industry with financial contributions from the federal and provincial governments.

The Alberta government and most major Alberta industries have participated in the Accelerated Reduction/Elimination of Toxics (ARET) Program. ARET has expanded from a private-sector initiative to a national program. It is an experiment to determine whether voluntary commitments to reduce or eliminate emissions can achieve environmental goals faster and more flexibly than regulations alone. It is also an example of how governments, citizens' groups and businesses can work together to develop national approaches to important environmental issues.

Recently, the Working Group on Air Quality Objectives and Guidelines of the Federal-Provincial Advisory Committee on Air Quality under the Canadian Environmental Protection Act has begun to revise the process by which ambient air quality objectives are derived in Canada. The process is split into two parts. Representatives from the departments of environment and health from national and provincial governments are participating in the development of the protocol. This two-part process replaces the three-tier process previously used in Canada.

## SUMMARY

Over the past years, key elements or components of air toxics management have evolved in Alberta. While the management system has advanced considerably in terms of sophistication and detail it remains principally a regulatory or "command and control" approach. The key elements of the management system are consistent with and complimentary to other programs and initiatives such as the federal Toxic Substances Management Policy and the proposed Canadian Council of Ministers of Environment's Policy for Management of Toxic Substances. These key components of the air toxics management program in Alberta are:

- Goals;
- Policies;
- Ambient Guidelines or Prescribed Ambient Levels;
- Source Emission Standards;
- Plume Dispersion Modelling;
- Ambient Air Monitoring;
- Source Emissions Monitoring;
- Environmental Reporting;
- Emission Inventory;
- Approvals;
- Inspection/Abatement;

- Enforcement; and
- Research.

The system is designed to ensure that emissions are minimized through the use of BAT or BADT and to ensure that ambient air quality meets the high standards that Albertans desire.

**Table 1. Airborne Toxic Substances relevant to Alberta, Typical Sources and link to CEPA.**

| Chemicals | Typical Sources[1] | CEPA Linkage[2] |
|---|---|---|
| 1,1,1 Trichloroethane | 5,7 | 1 |
| 1,1,2,2 Tetrachloroethane | 7 | 3 |
| 1,3-Butadiene | 8 | 4 |
| Acetaldehyde | 1 | 4 |
| Acetic Acid | 1 | 5[c] |
| Acetone | 1 | 5[c] |
| Ammonia | 1,3 | 5[c] |
| Arsenic and Compounds | 4,6 | 5[a] |
| Benzene | 1,7 | 1 |
| Beryllium and Compounds | 4,5 | 5[a] |
| Butane | 5,8 | 5 |
| Cadmium and Compounds | 4,5,6 | 5[b] |
| Carbon Disulphide | 1,5 | 4 |
| Carbon Monoxide | 1,2,4,5,6,8,9 | 6 |
| Carbon Tetrachloride | 1,7 | 1 |
| Chlorine | 1 | 5[c] |
| Chlorobenzene | 6,7,9 | 2 |
| Chloroform | 1,5,6,10 | 4 |
| Chloromethane | 1 | 5[c] |
| Chromium and Compounds | 1,4,5 | 5[a] |
| Dichlorobenzene | 1,5 | 3 |
| Dichloromethane | 7 | 1 |
| Dimethyl ether | 1,4,5,6 | 5 |
| Dioxins and Furans (PCDD and PCDF, 10 congeners and 15 isomers) | 4,5,6,9,10 | 1 |
| Ethyl Benzene | 5,7 | 5[c] |
| Ethyl Chloroformate | 1 | 5 |
| Ethylene | 1 | 5 |
| Ethylene Dibromide | 5,7 | 5[d] |
| Ethylene Dichloride | 1,5,7 | 5[d] |
| Ethylene Oxide | 1 | 4 |
| Ethyltoluene | 1 | 5 |
| Fluorides | 1,2 | 5 |
| Formaldehyde | 1,2 | 4 |
| Hydrogen Chloride | 1,5,9 | 5[c] |
| Hydrogen Sulphide | 5,10 | 6 |
| Isobutylbenzene | 1 | 5 |
| Lead and Compounds | 4,9 | 1 |
| Mercury and Compounds | 6,7,9 | 1 |
| Methanol | 1 | 5[c] |
| Methyl Tertiary-Butyl Ether (MTBE) | 1,5 | 2 |
| Methylcyclopentane | 5 | 5 |

| | | |
|---|---|---|
| Methylcyclohexane | 5 | 5 |
| Methylene Diphenyl Diisocyanate (MDI) | 2,10 | 5 |
| Monoethylamine | 1,5 | 5[c] |
| Nickel and Compounds | 4,5,6,9 | 5[a] |
| Nitrogen Dioxide | 1,2,3,4,5,6,8,9,10 | 6 |
| Ozone | Secondary pollutant | 6 |
| Phenol | 1,9 | 5 |
| Phosgene | 1 | 5 |
| Polychlorinated Biphenyl | 6,9 | 1 |
| Polycyclic Aromatic Hydrocarbons (PAHs, 31 compounds) | 1,2,3,4,5,6,8,9,10 | 1 |
| Styrene | 1 | 3 |
| Sulphuric Acid | 1 | 5[c] |
| Sulphur Dioxide | 1,5,6,8 | 6 |
| Suspended Particulates | 2,4,8,10 | 6 |
| Tetrachloroethylene | 1,7 | 1 |
| Toluene | 5,7,8 | 2 |
| Trichloroethylene | 1,7 | 1 |
| Trimethylbenzene | 1 | 1 |
| Vinyl Chloride | 1 | 1 |
| Xylene | 4,7,8 | 2 |

[1] Industry type
1 - Chemicals
2 - Construction
3 - Food and Animal By-products
4 - Metals and Minerals Processing
5 - Oil and Gas
6 - Power Plants
7 - Solvents from dry cleaning and printing facilities.
8 - Vehicle exhausts, wood burning stoves and fire places
9 - Waste incinerators
10 - Wood Products

[2] Groupings pertinent to the federal CEPA initiatives
1 - CEPA Toxic substances
2 - PSL-1 non-toxic substances
3 - PSL-1 substances having insufficient information for assessment
4 - PSL-2 substances
5 - Substances not in any PSL lists
[a] CEPA Schedule III, Part 2 (Sections 71 and 72) – List of Restricted Substances
[b] CEPA Schedule III, Part 1 (Section 71 and 72) – List of Prohibited Substances
[c] PSL-2 nominated substances
[d] CEPA Schedule II, Part 2 (Section 41 to 43) – List of Toxic Substances Requiring Exporting Notification
6 - Criteria pollutants

**Table 2. Non-criteria Substances Regulated Under Approvals And Their Prescribed Ambient Levels.**

| CHEMICALS | Prescribed ambient level ($\mu g/m^3$) | | | CEPA Linkage |
|---|---|---|---|---|
| | 1-hour | 24-hour | Source | |
| Acetaldehyde | 90 | | T | 4 |
| Acetic acid | 250 | | T | 5 |
| Acetone | 5900 | | T | 5 |
| Benzene | 30 | | T | 1 |
| Carbon disulphide | 30 | | T | 4 |
| Chlorine | 15 | | T | 5 |
| Chlorine disulphide | 2.8 | | T | 5 |
| Chromium | 1 | | T | 5 |
| Dimethyl ether | 19100 | | T | 5 |
| Ethyl chloroformate | 0.57 | | | 5 |
| Ethylene | | 120 (6-hr avg.) | O | 5 |
| Ethylene oxide | 15 (30-min avg.) | | O | |
| Formaldehyde | 65 | | O | 4 |
| Hydrogen chloride | 75 | | T | 5 |
| Hydrogen fluoride | 4.9 | | T | 5 |
| Lead | 1.5 | | T | 1 |
| Methanol | 2620 | | T | 5 |
| Methylene diphenyl isocyanate (MDI) | 0.51 | | T | 5 |
| Monoethylamine | 1.19 | | | 5 |
| Phenol | 100 | | | 5 |
| Phosgene | 4 | | T | 5 |
| Styrene (vinyl benzene) | 215 | | T | 3 |
| Sulphuric acid | 10 | | T | 5 |
| Total reduced sulphur | 14 (as $H_2S$) | 4 (as $H_2S$) | A | 4 (as $CS_2$) |
| Vinyl chloride | 130 | | T | 1 |

Notation in Source column: A – Alberta Ambient Air Quality Guidelines
O – based on the Ontario Point of Impingement Standards
T – based on the Texas Effects Screening Level

**Table 3. Non-criteria Substances Monitored by Industry as Required in Approvals.**

| CHEMICALS | INDUSTRY |
|---|---|
| Acetalaldehyde | Chemicals |
| Acetic acid | Chemicals |
| Acetone | Chemicals |
| Benzene | Chemicals |
| Butane | Oil and Gas |
| Carbon disulphide | Chemicals |
| Dioxins and Furans | Incineration |
| Ethylbenzene | Chemicals |
| Ethylene | Chemicals |
| Fluorides | Chemicals |
| Formaldehyde | Wood Product |
| Isobutylbenzene | Oil and Gas |
| Methanol | Oil and Gas |
| MTBE | Oil and Gas |
| Particulate matter ($PM_{10}$) | Wood Product |
| PCBs | Special Waste Treatment |
| Sodium chloride | Chemicals |
| Styrene | Chemicals |
| Toluene | Chemicals |
| Total reduced sulphur | Wood Product |
| Vinyl chloride | Chemicals |

## APPENDIX A: Alberta Ambient Air Quality Guidelines

**Table A1. Alberta Ambient Air Quality Guidelines.**

| AIR QUALITY PARAMETER | GUIDELINE |
|---|---|
| Sulphur Dioxide | 450 $\mu g/m^3$ as a 1-hour average concentration<br>150 $\mu g/m^3$ as a 24-hour average concentration<br>30 $\mu g/m^3$ as an annual arithmetic mean |
| Hydrogen Sulphide | 14 $\mu g/m^3$ as a 1-hour average concentration<br>4 $\mu g/m^3$ as a 24-hour average concentration |
| Nitrogen Dioxide | 400 $\mu g/m^3$ as a 1-hour average concentration<br>200 $\mu g/m^3$ as a 24-hour average concentration<br>60 $\mu g/m^3$ as an annual arithmetic mean |
| Carbon Monoxide | 15 $\mu g/m^3$ as a 1-hour average concentration<br>6 $\mu g/m^3$ as a 24-hour average concentration |
| Ground Level Ozone | 160 $\mu g/m^3$ as a 1-hour average concentration<br>50 $\mu g/m^3$ as a 24-hour average concentration |
| Suspended Particulates | 100 $\mu g/m^3$ as a 24-hour average concentration<br>60 $\mu g/m^3$ as an annual geometric mean |
| Dustfall | 53 $mg/100cm^2$/30days in residential and recreation areas<br>158 $mg/100cm^2$/30days in commercial and industrial areas |
| Smoke and Dust | 90% of the readings per month shall be less than 1.0 COH unit |
| Ammonia | 2.0 ppm as a 1-hour average concentration |
| Static Total Sulphation | 0.50 mg $SO_3$ equivalent/day/$100cm^2$ as 1-month accumulated loading |
| Static Hydrogen Sulphide | 0.10 mg $SO_3$ equivalent/day/$100cm^2$ as 1-month accumulated loading |
| Static Fluorides | 40.0 $\mu g$ water soluble fluoride/$10cm^2$/30days |

## APPENDIX B: CEPA Priority Substances Lists

The Canadian Environmental Protection Act (CEPA) has established a process for determining if substances are toxic and for managing them. The Priority Substances Assessment Program is mandated under Section 12 of the Act. That Section instructs the Ministers to develop a list of substances that should be given priority for assessment to determine whether they are "toxic". Candidate substances are assessed as CEPA toxic or equivalent using established risk-based assessment techniques and procedures, including exposure and inherent toxicity of a substance. The first Priority Substance List (PSL-1) contains 44 substances, of which 25 substances were concluded to be toxic (Table B1). The second Priority Substance List (PSL-2), released in December 1995, contains another 25 substances given priority for assessment (Table B2). In addition, a substance may also be subject to control without an assessment under the Priority Substances Assessment Program if Environment Canada and Health Canada are satisfied that the substance meets the criteria for toxic under the Canadian Environmental Protection Act (substances in Schedule 1 of CEPA as given in Table B3). An example is Dioxins and Furans. A federal-provincial Task Force on Dioxins and Furans was established in 1995 by the Federal-Provincial Advisory Committee on Air Quality under the Canadian Environmental Protection Act.

CEPA Toxic Substances have been or will be assigned to either: Track 1 for "Virtual Elimination" – if predominantly anthropogenic and the criteria for persistence and bioaccumulation are met; or Track 2 for "Full Life Cycle Management to prevent or minimize release" – if not all criteria are met. The criterion for persistence in any medium is its half-life:

| | |
|---|---|
| | in air > 2 days; |
| or | in water and in soil > 182 days; |
| or | in sediment > 365 days. |

The criterion for bioaccumulation is its BAF or BCF > 5,000 or log $K_{ow}$ >5; where BAF denotes the Bioaccumulation Factor, BCF the Bioconcentration Factors and log $K_{ow}$ the octanol-water partition coefficient. Predominantly anthropogenic is defined as "concentration in environment largely resulting from human activity". Management actions on these substances will follow the Canadian Council of Ministers of Environment's control strategies or the Canadian Environmental Protection Act's Strategic Options Process (SOP). SOP involves representatives from the federal and provincial governments and the particular industrial sectors, and makes recommendations to the Federal Ministers of Health and Environment on regulatory and non-regulatory tools for managing toxic substances. It considers such things as the sources, release rates and potential effects; existing pollution-control technologies; an assessment of various management options; target markets; and impacts on competitiveness.

### Table B1. Results of PSL 1 Assessment.

Substances concluded to be toxic:

| | |
|---|---|
| Benzene | Inorganic arsenic compounds |
| Benzidine | Inorganic cadmium compounds |
| Bis(2-ethylhexyl) phthalate | Inorganic fluorides |

Bis(chloromethyl) ether
Chlorinated wastewater effluents
Chloromethyl methyl ether
Creosote-contaminated sites
3,3'-Dichlorobenzidine
1,2-Dichloroethane
Dichloromethane
Effluents from pulp mills using bleaching
Hexachlorobenzene
Hexavalent chromium compounds
Oxidic, sulphidic and soluble, inorganic nickel compounds
Polychlorinated dibenzodioxins
Polychlorinated dibenzofurans
Polycyclic aromatic hydrocarbons
Refractory ceramic fibre
Short chain chlorinated paraffins
Tetrachloroethylene
1,1,1-Trichloroethane
Trichloroethylene

Substances not considered to be "toxic":

Chlorobenzene
Dibutyl phthalate
Methyl methacrylate
Methyl tertiary-butyl ether
Toluene
Xylenes

Substances having insufficient information in specific aspects of the assessment to conclude whether they are "toxic"

Aniline
Bis(2-chloroethyl) ether
1,2-Dichlorobenzene
1,4-Dichlorobenzene
3,5-Dimethylaniline
Di-n-octyl phthalate
Organotin compounds (non-pesticidal)
Pentachlorobenzene
Styrene
Tetrachloroethane
1,1,2,2-Tetrachloroethane
Trichlorobenzenes
Waste crankcase oils

**Table B2. PSL 2 Assessment list.**

Acetaldehyde
Acrolein
Acrylonitrile
Aluminum chloride, aluminum nitrate, Aluminum sulphate
Ammonia in the aquatic environment
1,3-Butadiene
Butylbenzylphthalate (BBP)
Carbon disulfide
Chloramines
Chloroform
N,N-Dimethylformamide (DMF)
2-Methoxy ethanol, 2-ethoxy ethanol, 2-butoxy ethanol
N-Nitrosodimethylamine (NDMA)
Nonylphenol and its ethoxylates (NPE)
Phenol
Releases from primary and secondary copper smelters and copper refineries
Releases from primary and secondary zinc smelters and zinc refineries
Releases of radionuclides from nuclear facilities (impacts on non-human species)

Ethylene glycol
Ethylene oxide
Formaldehyde
Hexachlorobutadiene (HCBD)
Respirable particulate matter less than or equal to 10 microns
Road salts
Textile mill effluents

**Table B3. Schedule 1 of the Canadian Environmental Protection Act (List of Toxic Substances).**

1. Chlorobiphenyls that have the molecular formula $C_{12}H_{10-n}Cl_n$ in which "n" is greater than 2
2. Dodecachloropentacyclo decane
3. Polybrominated Biphenyls that have the molecular formula $C_{12}H_{10-n}Br_n$ in which "n" is greater than 2
4. Chlorofluorocarbon: totally halogenated chlorofluorocarbons that have the molecular formula $C_nCl_xF_{(2n+2-x)}$
5. Polychlorinated Terphenyls that have a molecular formula $C_{18}H_{14-n}Cl_n$ in which "n" is greater than 2
6. Asbestos
7. Lead
8. Mercury
9. Vinyl Chloride
10. Bromochlorodifluoromethane that has the molecular formula $CF_2Br$
11. Bromotrifluoromethane that has the molecular formula $CF_4Br$
12. Dibromotetrafluoroethane that has the molecular formula $C_2F_4Br_2$
13. Fuel containing toxic substances that are dangerous goods within the meaning of section 2 of the Transportation of Dangerous Goods and that (a) are neither normal components of the fuel nor additives designed to improve the characteristics or the performance of the fuel; or (b) are normal components of the fuel or additives designed to improve the characteristics or the performance of the fuel, but are present in quantities or concentrations greater than those generally accepted by industry standards
14. Dibenzo-para-dioxin that has the molecular formula $C_{12}H_8O_2$
15. Dibenzofuran that has the molecular formula $C_{12}H_8O$
16. Polychlorinated dibenzo-para-dioxins that have the molecular formula $C_{12}H_{(8-a)}O_2Cl_n$ in which the "n" is grater than 2
17. Polychlorinated dibenzofurans that have the molecular formula $C_{12}H_{(8-a)}OCl_n$ in which the "n" is grater than 2
18. Tetrachloromethane (carbon tetrachloride, $CCl_4$)
19. 1,1,1-trichloroethane (methyl chloroform, $CCl_3$-$CH_3$)
20. Bromofluorocarbon other than those set out in items 10 to 12
21. Hydrobromofluorocarbons that have the molecular formula $C_nH_xF_yBr_{(2n+2-x-y)}$ in which $0<n\leq3$
22. Methyl Bromide
23. Bis(chloromethyl) ether that has the molecular formula $C_2H_4ClO$
24. Chloromethyl methyl ether that has the molecular formula $C_2H_5ClO$
25. Hydrochlorofluorocarbons that have the molecular formula $C_nH_xF_yCl_{(2n+2-x-y)}$ in which$0<n\leq3$